

МИНИСТЕРСТВО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ  
Курганский государственный университет  
Кафедра иностранных языков технических специальностей

## АНГЛИЙСКИЙ ЯЗЫК

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по развитию навыков чтения и перевода  
для студентов 2 курса направления 100400  
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## Lesson 1.

### Task 1. Read the text and answer the following questions:

1. Since when has electricity been known?
2. What did the Greeks discover?
3. What terms does anyone need to know when buying and using electrical appliances?

#### Electricity.

Electricity has been known since the days of the ancient Greeks. The word “electricity” comes from the Greek word for amber. The Greeks discovered that if a piece of amber was rubbed with fur, it would pick up bits of straw or other light-weight materials. Later scientists discovered that other materials would act like amber. Charges of electricity are called charges of frictional or static electricity. They are not very useful.

In 1800 an Italian scientist named Volta found a way of getting an electric current. He invented an electric cell. But electricity became truly useful after Michael Faraday invented a machine to push electrons on their way. A machine which furnishes a current of electricity is called a generator. Today we use both cells and generators.

When buying and using electrical appliances there are some terms everyone needs to know. “Volt” is one. “Ampere” is another. “Watt” is the third. The push that forces a current through a circuit is measured in volts. A volt is a measure of electrical force. Most household appliances are built for a voltage of either 127 or 220. An ampere is a measure of the strength of a current. Electric lamp bulbs are marked in watts. A watt is a measure of electrical power. A kilowatt is 1,000 watt.

#### Words:

1. amber	янтарь
2. charges of electricity	электрические заряды
3. frictional electricity	электричество трения
4. static electricity	статическое электричество
5. cell	элемент
6. to furnish	снабжать
7. appliances	(эл.) приборы
8. volt	вольт
9. ampere	ампер
10. watt	ватт
11. circuit	(эл.) цепь

### Task 2. Complete the following sentences:

1. The Greeks discovered that ... .
2. But electricity became truly useful after ... .
3. A battery is made up of ... .
4. In buying and using electrical appliances ... .
5. In 1800 an Italian scientist named Volta found ... .
6. Most household appliances are built ... .
7. We use batteries in such things as ... .
8. An ampere is a measure of ... .
9. Electricity has been known since ... .
10. The push that forces a current ... .
11. A watt is a measure of ... .

**Task 3. Agree or disagree with the following statements:**

1. Most household appliances are built for a voltage of either 127 or 220. 2. In 1900 an Italian scientist named Volta found a way of getting an electric current. 3. A battery is made up of one electric cell. 4. A kilowatt is more than 1,000 watts. 5. Today we use only generators. 6. The word “electricity” comes from the Greek word for amber. 7. The push that forces a current through a circuit is measured in volts. 8. Electric lamp bulbs are marked in watts. 9. An ampere is a measure of electrical power. 10. The current that comes to our houses and offices and lights our streets does not come from generators. 11. A watt is a measure of the strength of a current.

**Task 4. Ask general questions:**

1. Electric lamp bulbs are marked in watts. 2. Electric currents may be set up through solids, liquids or gases – even through a vacuum. 3. The number of electric charges passing through any given area per second is a measure of the current strength through that area. 4. An electric charge can pass easily through some materials. 5. An electric charge flows with difficulty through certain materials. 6. Materials which do not permit the easy flow of charges through their structures are called non-conductors or insulators. 7. Michael Faraday invented a machine to push electrons on their way. 8. A battery is made up of two or more electric cells joined together. 9. We use batteries in such things as portable radios, electric games and automobiles. 10. Charges of electricity are called charges of frictional or static electricity. 11. The current which comes to our houses and offices and lights our streets comes from generators.

**Task 5. Ask special questions using the question-word given in brackets:**

1. In 1800 an Italian named Volta found a way of getting an electric current. (when) 2. The word “electricity” was known in ancient Greece. (where) 3. Electricity became truly useful after Michael Faraday invented a machine to push electrons on their way. (when) 4. The current which comes to our houses and offices and lights our streets comes from generators. (where) 5. In 1800 an Italian scientist named Volta found a way of getting an electric current. (who) 6. A battery is made up of two or more electric cells. (how many) 7. We use batteries in such things as portable radios, electric games and automobiles. (who) 8. Today we use both cells and generators. (what) 9. The push that forces a current through a circuit is measured in volts. (what) 10. Most household appliances are built for a voltage of either 127 or 220. (what) 11. An electric charge flows with difficulty through certain materials. (where)

**Task 6. Retell the text.**

**Task 7. Read and retell the text given below. Do not use a dictionary.**

Proposed 500-kV Line will be Tenaga National Berhad’s Transmission Backbone (Part I).

Introduction.

Tenaga National Berhad, a private Malaysian utility, expects electrical capacity demand on its facilities to increase more than 450 percent over the next 20

years. A multi-company consortium will build the 500-kV electric transmission system necessary to accommodate such a generation increase. The system will eventually serve as the transmission backbone for Tenaga National Berhad operations. In August 1999, Tenaga National Berhad entered into an agreement with the consortium (Ranhill Bersekutu and Black & Veatch International) to design and manage construction for the first phase of the multi-staged project. Power Technologies Inc., a subcontractor to Black & Veatch, was responsible for power system studies.

Phase 1, planned with five substations, will stretch approximately 380 km along Peninsular Malaysia's west coast from Port Klang in the state of Selangor to Gurun in the state of Kedah. Phase 1A, another initial construction phase planned with four substations, originates at Pasir Gudang north of Singapore and proceeds northwesterly in the state of Johor for approximately 135 km to the Yong Peng area.

Phase 1 and Phase 1A are part of an overall scheme to provide reliable electric transmission within Malaysia. While all construction will suit double circuit 500-kV transmission, the utility will energize initially only one project section and two substations at 500 kV. Tenaga National Berhad will energize the remaining construction at 275 kV. The system design allows for future conversion to 500 kV with minimized outage time. Tenaga National Berhad must complete new construction on schedule because the existing transmission system can not support additional generation.

**Task 8. Make up written translation of the text. Use a dictionary.**

Many of the world's electric utilities and independent power producers are turning to gas turbine combined-cycle power technology for new capacity. The major reasons for the predominance of this technology are high efficiency, moderate capital cost, low environmental impact, favorable natural gas prices and short construction schedules. Recent advances in gas turbine technology allow for a combined-cycle efficiency of almost 60 percent.

Another benefit of combined-cycle technology is it can be constructed in phases. The first phase would be the installation of a gas turbine for simple-cycle operation. Then, as additional capacity is needed, a steam turbine with a heat recovery steam generator is added.

Unlike steam turbines that are inclined to be custom engineered and manufactured for specific plant applications, gas turbines tend to be an assembly line product. Gas turbines are available in discrete sizes.

Today manufacturers offer aeroderivative and heavy duty gas turbines. In simple-cycle operation aeroderivative machines are generally limited to 40 MW or less, while the heavy duty gas turbines can be supplied in sizes up to 240 MW. However, advanced heavy duty gas turbines with high firing temperatures, 1,290 C to 2,350 C, when operated on a combined-cycle configuration can generate 360 MW at an efficiency of 58.5 percent.

## Lesson 2.

### Task 1. Read the text. Find the translation and transcription of the words. Make up a vocabulary. Learn the words.

#### The Iriklienskaya State Regional Power Station.

The 2400 thou kW Iriklienskaya State Regional Power Station is the largest unit in the Orenburg Power System with condensing power sets.

The station is equipped with 8 power units rated each at 300 thou kW.

Each power unit comprises an once-through reheat steam generator, steam turbine and hydrogen-cooled generator.

The main building of the station has been built in accordance with a standard project.

Regenerative air heaters, induced- and forced-draft fans are disposed on the open ground.

A transverse arrangement of turbogenerators in the turbine room is adopted.

The unit heat flow diagram does not envisage any transverse water and steam connections.

The process water supply system is of the combined – direct flow and return-type with a submerged water intake from the Iriklienskaya water reservoir.

The electric energy generated by the station is transmitted along 500-, 220- and 110 kV lines.

As to the main fuel used at the station it is natural gas of the Bukharskoye gas field, furnace oil being used as a standby fuel.

For cleaning the effluents contaminated with oil products the station is furnished with purifying structures.

The State Regional Power Station is equipped with an automated process control system.

Ириклинская ГРЭС мощностью 2400 тыс. кВт – крупнейшая конденсационная электростанция энергосистемы Оренбургской области.

На ГРЭС установлено 8 энергоблоков мощностью по 300 кВт.

В состав каждого энергоблока входят прямоточный паровой котёл, паровая турбина и генератор с водородным охлаждением.

Главный корпус сооружён по типовому проекту.

Регенераторные воздухоподогреватели, дымососы и вентиляторы расположены вне главного корпуса.

Тепловая схема электростанции – блочная, без поперечных связей по основным потокам воды и пара.

Система технического водоснабжения прямоточно-оборотная с глубинным водозабором из Ириклинского водохранилища.

Выдача мощности электростанции осуществляется на напряжении 500, 200 и 110 кВ.

Для ГРЭС основным видом топлива является природный газ Бухарского месторождения, а в качестве резервного топлива – топочный мазут.

Для очистки стоков загрязнённых нефтепродуктов на ГРЭС имеются очистные сооружения.

На ГРЭС действует автоматизированная система управления технологическими процессами.

**Task 2. Complete the following sentences:**

1. For cleaning the effluents ... . 2. The electric energy generated by the station is ... . 3. The station is equipped with ... . 4. The main building of the station has been built ... . 5. A transverse arrangement of turbogenerators ... 6. The 2400 thou kW Iriklinskaya State Regional Power Station is ... . 7. The unit heat flow diagram does not ... . 8. The process water supply system is ... . 9. As to the main fuel used at the station ... . 10. Regenerative air heaters, induced- and forced-draft fans are ... . 11. The State Regional Power Station is equipped ....

**Task 3. Agree or disagree with the following statements:**

1. A transverse arrangement of turbogenerators in the turbine room is adopted. 2. The station is equipped with 7 power units rated each at 200 thou kW. 3. The unit heat flow diagram does not envisage any transverse water and steam connections. 4. The electric energy generated by the station is transmitted along 500 kV lines. 5. The 2400 thou kW Iriklinskaya State Regional Power Station is the smallest unit in the Orenburg Power System with condensing power sets. 6. Natural gas is used as a standby fuel. 7. Furnace oil is used as the main fuel. 8. Regenerative air heaters, induced- and forced-draft fans are situated in the main building. 9. For cleaning the effluents contaminated with oil products the station is furnished with purifying structures. 10. The main building of the station has been built in accordance with a standard project. 11. The State Regional Power Station is equipped with an automated process control system.

**Task 4. Ask alternative questions:**

1. The Iriklinskaya State Regional Power Station is the largest unit in the Orenburg Power System. 2. The station is equipped with 8 power units rated each at 300 thou kW. 3. Regenerative air heaters, induced- and forced-draft fans are disposed on the open ground. 4. A transverse arrangement of turbogenerators in the turbine room is adopted. 5. The unit heat flow diagram does not envisage any transverse water and steam connections. 6. Natural gas is the main fuel used at the station. 7. Furnace oil is used as a standby fuel. 8. The station is furnished with purifying structures for cleaning the effluents contaminated with oil products. 9. The State Regional Power Station is equipped with an automated process control system. 10. The main building of the station has been built in accordance with a standard project. 11. The electric energy generated by the station is transmitted along 500-, 220- and 110 kV lines.

**Task 5. Fill in the gaps with the words given below:**

standby fuel, effluents, automated process control system, natural gas, State Regional Power Station, standard project, power units, turbogenerators, induced- and forced-draft fans, electric energy, heat flow diagram, purifying structures.

1. The 2400 thou kW ... is the largest unit in the Power System with condensing power sets. 2. The main building of the station has been built in accordance with a

... . **3.** A transverse arrangement of ... in the turbine room is adopted. **4.** The unit ... does not envisage any transverse water and steam connections. **5.** Regenerative air heaters, ... are disposed on the open ground. **6.** The ... generated by the station is transmitted along 500-, 220- and 110 kV lines. **7.** As to the main fuel used at the station, it is ... . **8.** The State Regional Power Station is equipped with an ... . **9.** Furnace oil is used as a ... . **10.** The station is equipped with 8 ... rated each at 300 thou kW. **11.** For cleaning the ... contaminated with oil products the station is furnished with ... .

**Task 6. Retell the text.**

**Task 7. Translate the text about the Electrical Networks from Russian into English.**

Шадринские электрические сети были созданы в 1965 году. Число работающих составляет 700 человек.

В состав Шадринских электрических сетей входят пять районов и котельная в г. Шадринске мощностью 260 Гкал/ч.

Протяжённость линий электропередач составляет 1718 км. Шадринские электрические сети включают 55 подстанций.

**Task 8. Adapt the sentences given below:**

**1.** Messochora, the uppermost project of the Acheloos river hydropower development in Greece, including a 150 meters high rockfill dam with a total volume of  $4 \times 10^6 \text{ m}^3$  has an upstream concrete face slab, an open chute gated spillway, 7.5 km long concrete-lined headrace tunnel of 5.3 meters internal diameter and a semi-outdoor power plant with two 70 MW units.

**2.** The Aliakmon project, located near the village of Pigaes (Greece), has 1,560 meters diversion tunnels that are already excavated and concrete lined while the main diversion tunnel starts at the Aliakmon reservoir and leads to the Mouzaki reservoir.

**3.** The Polyphyto, Sfikia and Assomata projects in Greece operate in series with consideration for the amount of water that exits the Polyphyto reservoir every day to satisfy the downstream irrigation requirements during the summer.

**4.** In all fields of power plant engineering Siemens designs, develops and supplies systems, equipment and turn-key plants tailored towards pollution control and higher cost-effectiveness as only clean power generation will be able to meet the growing worldwide energy demand while conserving resources.

**5.** With the aid of computer-integrated manufacturing, for example, Siemens turbine manufacturing plant in Mulheim transfers the results of three-dimensional flow calculations directly into the manufacture of blades with integral shrouding.

**6.** According to the technology, the partial gasifier, the circulating atmospheric fluidized-bed combustion and the gas turbine operate together as an integrated system, forming a modular building block for the construction of plants with varying electric outputs.



7. According to figures from the International Institute for Energy Conservation, Washington, D.C., USA, the global energy market in the next decade is expected to be worth (US) \$1 trillion including a (US) \$84 billion world market for energy efficiency products and services.

8. Whether it is in the furnace and boiler systems of pyrolytic refuse incinerators or in the heat exchangers and post-combustion chambers of harmful waste incineration plants: Krupp VDM's ultra-low-corrosion-resistant super alloys are in use wherever raw gases with high sulfur, heavy metals and chloride contents demand very long component service lives.

9. Large-scale retrofits or reconstruction of existing manufacturing plants with newer process equipment and/or energy-efficient drives and motors make facilities more energy efficient and more competitive in selling goods un world markets.

10. Some key officials realize that demand-side management will decrease pollution from fossil-fired generating plants because the same amount of electricity used more efficiently will go a lot farther, thus improving economic competitiveness, refocusing utilities on a customer service mentality, and creating a local energy-service industry.

11. As one of the leaders in the field of power plant engineering worldwide, Germany has the expertise and the experience necessary for the reliable and sustainable supply of electric power – now and in the future.

**Task 9. Read and retell the text given below. Do not use a dictionary.**

Proposed 500-kV Line will be Tenaga National Berhad's Transmission Backbone (Part II).

Establishing Design Standards.

The primary challenge facing the design team during the initial design stages was to plan and design the system to meet the schedule. Conceptual design established parameters and determined preferred alternatives for detailed design. This was especially important for Tenaga National Berhad new project since the country has no 500-kV system.

Although transmission line and substation designs are subject to the requirements of the Malaysian Electric Supply Regulations, the current regulations do not contain requirements for 500-kV safety, construction and operation. Using experience from other projects and references to acceptable 500-kV standards, the team established design criteria and inclined them in a Project Design Manual. Once submitted and accepted for inclusion in the next Malaysian Electric Supply Regulations edition, the criteria will serve as safety, construction and operation guidelines for future 500-kV construction in Malaysia.

**Task 10. Make up written translation of the text. Use a dictionary.**

World's Largest Combined-Cycle Power Plant.

What is reported to be the world's largest combined-cycle gas turbine power plant, Teeside Power in the north of England, has been in commercial operation since the middle of 1995. Not only has the plant replaced an old coal-fired power plant, it has also helped the United Kingdom meet emission targets set by the

European Union. The plant is owned by Teeside Power Ltd., a joint venture company.

Teeside power plant comprises eight 146 MW rated gas turbine generators and heat recovery steam generators and two 283 MW steam turbine generators. Teeside power plant has a triple fuel system. Natural gas is the primary fuel while liquid naphtha is the main backup fuel. Initially, the plant is being fired with natural gas supplied by British Gas.

When natural gas is unavailable the gas turbines will operate on naphtha. Should this be needed, the gas turbines will first be started, one or two at a time, on propane and at about 20 MW transferred to operation on naphtha. However, should the gas turbines be in operation when natural gas is curtailed, they would be automatically transferred to naphtha once the distributed control system has confirmed that the pumps on the naphtha skid are operating. During the changeover the distributed control system would back off the load by about 10 MW. Should the natural gas supply be restored while the gas turbines are operating on naphtha, the gas turbines, one or two at a time, would be returned to burning natural gas. The naphtha fuel is supplied at ambient temperature. The steam can be used for increasing the output of the gas turbines.

### **Lesson 3.**

#### **Task 1. Read the text and answer the following questions:**

**1.** What did ancient people call heat? **2.** What ways of producing heat do you know? **3.** What is central heating?

#### **Heat.**

In ancient times people thought that heat was a material just as air is. They called it “caloric”. When something got warm, they said, caloric flowed into it. When something cooled off, caloric flowed out of it. It didn’t bother them that they could not see caloric. They could not see the air either.

Now we know that heat is not a material. It does not take up any space. It does not weigh anything. It is a form of energy. Saying that heat is a form of energy means that it can be used to perform work. When we see an automobile speeding down the road we can be sure that it is being driven by the heat of burning gasoline.

There are many ways of producing heat. Fire, friction and electricity are three of them. All our ways of producing heat, however, would not keep the Earth warm enough for us to live on, if it were not for the Sun. It has given the Earth heat for millions of years. It will keep on giving the Earth heat for millions of years to come.

Heat travels much better through some materials than through others. It travels easily through metals. We say that they are good conductors of heat. Wool, asbestos and still air are three of the many poor conductors of heat. We use poor conductors to shut heat in or to shut it out. Heat can also travel without the use of any material conductor. The Sun’s heat reaches us across almost empty space in the form of rays which the Sun sends out.

Most substances expand or get bigger when they are heated. Engineers must allow room for expansion when they build concrete roads and steel bridges. Heat brings about many other changes in materials. Heating some solid substances makes them melt. Heating liquids makes them change to a vapour.

Very long ago people came to the idea of heating their homes. The idea of heating with fire is not new. Thousands of years ago the cave-men were using fire for heating. The Romans worked out the way of heating all the rooms in their houses with one fire. The fire was built in a room called the atrium. "Atrium" means "black room". It got its name from the soot that coated its walls. From this room hot air was carried through pipes to the rest of the house. Heating all the rooms of the building from one source of heat is called central heating. After the days of the Romans the idea of central heating was given up for 1,500 years. People went back to the idea of a fire in each room. And only much later central heating became popular again.

Words:

1. in ancient times	в древние времена
2. caloric	теплота
3. to cool	охлаждать(ся)
4. gasoline	бензин
5. to produce heat	производить теплоту
6. friction	трение
7. conductor	проводник
8. concrete	бетон
9. vapour	пар
10. soot	сажа

**Task 2. Complete the following sentences:**

1. Saying that heat is a form of energy means that ... . 2. When we see an automobile speeding down a road ... . 3. Heating all the rooms of a building ... . 4. Engineers must allow room for expansion when ... . 5. All of our ways of producing heat ... . 6. Heat can also travel ... . 7. The Sun's heat reaches us ... . 8. Heat travels much better through ... . 9. Most substances expand ... . 10. In ancient times people thought that ... . 11. Very long ago people ... .

**Task 3. Agree or disagree with the following statements:**

1. Most substances get smaller when they are heated. 2. In ancient times people thought that heat was a material just as air is. 3. After the days of the Romans the idea of central heating was given up for 1,000 years. 4. Saying that heat is a form of energy means that it can be used to do work. 5. The Sun's heat reaches us across almost empty space in the form of rays which the Sun sends out. 6. There are only few ways of producing heat. 7. All of our ways of producing heat would keep the Earth warm enough for us to live on. 8. Wool, asbestos and still air are good conductors of heat. 9. Heating some solid substances makes them melt. 10. The Romans worked out the way of heating all the rooms in their houses with a fire in

each room. **11.** Heating all the rooms of a building from one source of heat is called central heating.

**Task 4. Ask general questions:**

**1.** In ancient times people thought that heat was a material just as air is. **2.** We know that heat travels faster through some materials than through others. **3.** We use poor conductors to shut heat in or to shut it out. **4.** Most substances expand or get bigger when they are heated. **5.** Heat can bring about many changes in materials. **6.** Heating some solid substances makes them melt. **7.** Heating liquids makes them change to a vapour or gas. **8.** All of our ways of producing heat would not keep the Earth warm enough for us to live on, if it were not for the Sun. **9.** Very long ago people came to the idea of heating their homes. **10.** The Romans worked out the way of heating all the rooms in their houses with one fire. **11.** Later people went back to the idea of a fire in each room.

**Task 5. Ask special questions using the question-word given in brackets:**

**1.** In ancient times people thought that heat was a material just as air is. (who) **2.** Ancient people called heat “caloric”. (how) **3.** Engineers must allow room for expansion when they build concrete roads and bridges. (when) **4.** Very long ago people came to the idea of heating their homes. (when) **5.** Thousands of years ago the cave-men were using fire for heating. (when) **6.** The Romans worked out the way of heating all the rooms in their houses with one fire. (who) **7.** Heating all the rooms of a building from one source of heat is called central heating. (how) **8.** Metals are good conductors of heat. (what) **9.** Heating some solid substances makes them melt. (what) **10.** After the days of the Romans the idea of central heating was given up for 1,500 years. (when) **11.** The Sun’s heat reaches us across almost empty space in the form of rays. (how)

**Task 6. Retell the text.**

**Task 7. Read the text about the Kargalinskaya Heating and Power Plant and make up a story about the Kurgan Heating and Power Plant.**

The Kargalinskaya Heating and Power Plant.

The installed generating capacity of the plant is 320 thou kW, its heating capacity being 1030 Gcal/h. The first 60 thou kW power unit was put into operation in 1973. The Kargalinskaya Heating and Power Plant is intended for supplying electric and heat energy to a number of gas-processing works and is of great economic significance. The Kargalinskaya Heating and Power Plant uses natural gas as the main fuel. The plant is equipped with two PT-60 turbines, four R-50 turbines and six BKZ-420 turbines. The Kargalinskaya Heating and Power Plant is characterized by over-all automation of all the major technological processes. The plant is furnished with the modern means of automation.

Information to be used:

Курганская ТЭЦ:

Год создания – 1956

Число работающих – 1672

Установленная электрическая мощность – 480 МВт

Установленная тепловая мощность – 1756 Гкал/ч

Основное оборудование: 2 турбины ПТ-60-130/13; 4 турбины Т-110/120-130; 6 энергетических котлов БК-420; водогрейная котельная на 500 Гкал/ч

Переведены на сжигание природного газа водогрейные котлы № 1-5; энергетические котлы № 1-4, 8-12.

**Task 8. Read and retell the text given below. Do not use a dictionary.**

Proposed 500-kV Line will be Tenaga National Berhad's Transmission Backbone (Part III).

Substation Electrical Design.

The team designed switchyards for a 1.5 breaker configuration with bays consisting of three circuit breakers connected between two main buses, with a line or transformer termination between any two breakers. This arrangement gives Tenaga National Berhad high reliability and achieves maximum flexibility during system operations and maintenance.

A typical substation arrangement allows for fifteen 500-kV circuit breakers associated with six transmission line positions and four transformer positions, and twenty one 275-kV circuit breakers associated with 10 line positions and four transformer positions. The 500/275-kV auto transformers are single-phase with a 750-megavolt-ampere capacity for each three-phase bank. The design team established electrical clearances and insulation coordination for the outdoor air-insulated buswork in accordance with International Electrotechnical Commission and industry standards. Designers developed electrical parameters, voltage ratings, installation level and clearances for substation design, as well as establishing parameters for bus loading and deflection. The bus design uses low profile aluminum bus with cable jumpers for major equipment including transformers, circuit breakers, disconnect switches and instrument transformers. Shield wires and lightning masts protect the substation from direct lightning strikes, and surge arrestors will shunt lightning strikes occurring outside the substation.

All substation equipment and material will conform to International Electrotechnical Commission standard requirements and will be suitable for operation at temperatures from 0 to 45 C, at relative humidity levels between 80 percent and 100 percent, and at altitude below 1,000 m. All equipment will operate on a three-phase, 50-Hz, solidly grounded system.

**Task 9. Make up written translation of the text. Use a dictionary.**

Diesels In a Combined Cycle.

Power plant developers are now faced with a challenge: How does one design a power plant that is as clean and efficient as natural gas-fired plant, uses proven components, has better wide-range performance and dispatching characteristics than gas turbines, and is more economically competitive than integrated coal technology? The answer is diesels in a combined cycle.

Their position rests on the fact that the medium-speed diesel is already one of the most efficient simple-cycle sources of electricity, especially with lower grade fuels. Large units have heat-rate efficiencies as high as 45 percent and no other power production prime mover can match this efficiency. Diesels also offer designers fuel flexibility and can burn an extreme variety of fuels without sacrificing many of their positive operating attributes.

Diesels are the first building block in a highly efficient combined-cycle system that relies on the hot gas and oxygen in the diesel's exhaust to combust either natural gas, light distillate oil, heavy oil or coal in a boiler. Although the concept of recovering diesel exhaust heat and cooling water heat is not new, using diesels to help fire a boiler is. By using a fired boiler, steam can be generated at sufficient temperature and pressure to operate a steam cycle efficiently.

Diesel combined-cycle plants can be configured in much the same way as a gas turbine plant. However, the diesel combined-cycle scheme requires supplemental firing to generate appropriate steam conditions. Therefore, the most efficient cycle would not be achieved until combustion air and supplemental fuel are minimized to levels that satisfy steam conditions, steam generation and power generation constraints.

#### **Lesson 4.**

**Task 1. Read the text. Find the translation and transcription of the words. Make up a vocabulary. Learn the words.**

The Orskaya Heating and Power Plant.

The installed generating capacity of the Orskaya Heating and Power Plant is 315 thou kW, its heating capacity amounting 1168 Gcal/h.

The turbine units installed at the plant have process and district-heating steam bleedoffs. The plant is operating on blended fuel: gas, coal, mazut.

The plant is provided with a hydraulic ash-transport system and a new technique for chemical treatment of make-up water based on double-stage cation exchange. A whole range of works carried out at the plant enabled its staff to modernize the equipment in operation to bring down heat losses and provide constant maximum output. Now work is in progress at automation of all the combustion and feed processes on steam generators.

Установленная мощность Орской ТЭЦ – 315 тыс. кВт, тепловая – 1168 Гкал/ч.

На ТЭЦ установлены турбоагрегаты с промышленными теплофикационными отборами пара. Станция работает на смешанном топливе: газ, уголь, мазут.

На ТЭЦ действует гидравлическое золоудаление, внедрена новая технология химической обработки добавочной воды по двухступенчатой схеме катионного обмена, выполнен комплекс работ по реконструкции действующего оборудования с целью снижения потерь тепла и достижения устойчивых максимальных мощностей. На всех котлоагрегатах автоматизируются процессы

The mastering of high-temperature and high-pressure equipment and cutting down heat losses have improved the performance characteristics of the plant.

горения и питания.

Освоение оборудования высоких температур и высокого давления, снижение потерь тепла улучшили работу станции.

**Task 2. Agree or disagree with the following statements:**

1. The heating capacity of the Orskaya Heating and Power Plant is 1200 Gcal/h. 2. A whole range of works enabled its staff to bring down the heat losses and provide constant maximum output. 3. Now work is in progress at automation of all the combustion processes on steam generators. 4. The turbine units installed at the Orskaya Heating and Power Plant have process and district-heating steam bleedoffs. 5. The turbine units installed at the Orskaya Heating and Power Plant have district-heating bleedoffs. 6. The Orskaya Heating and Power Plant is operating on gas as the main fuel and coal as a standby fuel. 7. The Orskaya Heating and Power Plant is provided only with a hydraulic ash-transport system. 8. The Orskaya Heating and Power Plant is provided with a new technique for chemical treatment of make-up water based on double-stage cation exchange. 9. The mastering of high-temperature equipment has improved the performance characteristics of the Orskaya Heating and Power Plant. 10. The installed generating capacity of the Orskaya Heating and Power Plant is 1100 thou kW. 11. The mastering of high-pressure equipment and cutting down heat losses have improved the performance characteristics of the Orskaya Heating and Power Plant.

**Task 3. Fill in the gaps with the words given below:**

hydraulic ash-transport system, range, turbine units, high-temperature equipment, steam generators, blended fuel, double-stage cation exchange, installed generating capacity, steam bleedoffs, Heating and Power Plant, brings down heat losses, heating capacity.

1. The ... of the Orskaya ... is 1168 Gcal/h. 2. A whole ... of works is being carried out at the plant to modernize the equipment in operation. 3. The Orskaya ... is operating on ... gas, coal, mazut. 4. The plant is provided with a ... and a new technique for chemical treatment of make-up water based on double-stage cation exchange. 5. The staff of the plant ... and provides constant maximum output. 6. The ... of the Orskaya ... is 315 thou kW. 7. Now work is in progress at automation of all the combustion and feed processes on ... . 8. The ... installed at the plant have process and district-heating ... . 9. The mastering of ... and cutting down heat losses have improved the performance characteristics of the plant. 10. The Orskaya ... is provided with a new technique for chemical treatment of make-up water based on ... .

**Task 4. Choose the right answer for the following questions:**

1. What is the heating capacity of the Orskaya Heating and Power Plant? 1. The Orskaya Heating and Power Plant is operating on gas as the main

2. What kind of fuel is the Orskaya Heating and Power Plant operating on?
3. What equipment is the Orskaya Heating and Power Plant provided with?
4. What has improved the performance characteristics of the Orskaya Heating and Power Plant?
5. What are the turbine units installed at the Orskaya Heating and Power Plant equipped with?
- fuel and on coal as a standby fuel.
2. The Orskaya Heating and Power Plant is provided with a new technique for chemical treatment of make-up water based on double-stage cation exchange.
3. The turbine units installed at the Orskaya Heating and Power Plant have process and district-heating bleesoffs.
4. The turbine units installed at the Orskaya Heating and Power Plant have district-heating bleesoffs.
5. The heating capacity of the Orskaya Heating and Power Plant is 1168 Gcal/h.
6. The Orskaya Heating and Power Plant is operating on blended fuel: gas, coal, mazut.
7. The Orskaya Heating and Power Plant is provided with a hydraulic ash-transport system and a new technique for chemical treatment of make-up water based on double-stage cation exchange.
8. The mastering of high-temperature and high-pressure equipment and cutting down heat losses have improved the performance characteristics of the Orskaya Heating and Power Plant.
9. The Orskaya Heating and Power Plant is provided with a hydraulic ash-transport system.
- 10 The heating capacity of the Orskaya Heating and Power Plant is 350 Gcal/h.

**Task 5. Retell the text.**

**Task 6. Read and retell the text given below. Do not use a dictionary.**

Proposed 500-kV Line will be Tenaga National Berhad's Transmission Backbone (Part IV).  
Substation Controls.



The substations will use a combination of existing conventional-style controls and a microprocessor-based computer control system in conjunction with the microprocessor numerical protective relays. A computer-based monitoring system and computer terminals operating in a two-tier hierarchical decentralized control scheme will control substation functions. The system will incorporate disturbance recorders and fault locators into the same enclosures as the numerical protective relays.

Protective relaying design for the substations includes overlapping and redundant protection for all lines, buses and equipment. The protective relaying schemes include transmission line relaying, automatic reclosing (single-pole and three-pole selectable), transformer relaying, high impedance bus relaying and breaker failure relaying. To make redundant schemes functionally separate, the relays will have separate trip coils, separate direct current power sources, different current and voltage transformer inputs, separate trip coils, separate communication paths and separation of control cables for each scheme.

An optical ground wire fiber-optic communication network installed on the transmission lines will provide the telecommunication and telecontrol path for an optical telecommunication system. The telecommunication equipment at each substation will be redundant and protected against any single failure point. The telecontrol will provide control and monitoring of each of the substations through remote terminal units and the computer-based control scheme.

Access to the substations and their sheer size were major design considerations. Some land requirements exceeded 100 acres. Designers used computer analysis to optimize the substation platform level by minimizing excess cuts and fill importing. Regardless, extensive earthwork will be required at all substations sites, so site access is critical. Road construction must be adequate to accommodate not only typical operation and maintenance traffic, but also the heavy loads associated with transformers and other major equipment.

**Task 7. Make up written translation of the text. Use a dictionary.**

Innovations in Wind Energy (Part I).

Introduction.

New ultra-compact transformers are designed to generate high power-rating capacity in special applications, such as the new generation of wind turbines, in minimum space conditions. In a remote location in Scotland and at an altitude of 560 meters, 36 turbines have been installed to generate electric energy from wind. These turbines, with huge blades and towers, have no option but to perform. Every hour they generate electricity for households and industries, while reducing the use of expensive fuels and avoiding emissions.

In these turbines generating step-up transformers are installed for transforming the voltage for a wind-turbine generator of typically 690 V to the required voltage of the electric grid ranging from 10,000 V up to 36,000 V.

These step-up transformers are subject over long periods to higher loads when the wind speed reaches more than 20 meters per second. The generator causes more voltage and power fluctuations, stressing the integrity of the transformer.

Finally, the dimensions of the transformer should be reduced so that it can pass the tower door. Compactness is key.

### Lesson 5.

#### Task 1. Read the text and answer the following questions:

1. Is lightning a great natural source of electricity? 2. What is the dazzling flash of light caused by? 3. What is a lightning conductor made of? 4. Electricity and magnetism are closely connected, aren't they? 5. What happens when the electric current flows through a conductor? 6. May electricity flowing through a conductor be likened to water flowing through a pipe? 7. How does the resistance of a conductor vary? 8. Copper has a lower resistance than other metals, hasn't it? 9. What may vary in different parts of the country? 10. What ensures an even distribution of power all over the country?

#### Understanding Electricity.

One great natural source of electricity is lightning. The dazzling flash of light we see during a thunderstorm is caused by the discharge of electricity from one cloud to another. Sometimes the discharge may be from a cloud to earth. In this case the electricity may pass through a tree or a house. When this happens we say that the house is struck by a lightning. To avoid the risk of damage to buildings a lightning conductor is used. It is made of a metal rod, placed high on the building, which is connected by a thick conductor wire to a metal plate buried in the earth. If lightning strikes the building the charge is conducted safely to earth.

Electricity and magnetism are closely connected. Each may be used to produce the other. Around the poles of a magnet there is an area called a magnetic field. In this area the magnet exerts its attraction. The directions of this attraction and the shape of the magnetic field are shown by lines of force.

When the electric current flows through a conductor, a magnetic field is set up around it. The conductor becomes a magnet. If a conductor is made to rotate in the magnetic field, a pressure of electricity, called a voltage, is produced in it. This is the principle on which a dynamo produces electricity. Electricity flowing through a conductor may be likened to water flowing through a pipe. The amount of electricity, which flows, called the current, is measured in units called amps. The pressure of electricity, the voltage, is measured in volts.

Just as a thin pipe will not allow water to flow through it as a large one, so a thin conductor will not allow as much electricity to flow as a thick one. The restriction of the flow which is caused by the conductor is known as its resistance. A unit of resistance is called an ohm. The resistance of a conductor will also vary according to the material it is made of. Copper has a much lower resistance than other common metals. It is a very good conductor.

Current, voltage and resistance bear a definite relationship to one another. There are certain times during the day when this demand for power is very high and other times when it may be very low. These are known as peak and off-peak periods, and they may vary in different parts of the country. In order to operate the power stations more efficiently and economically they are all connected to a grid

system. This is a network of high voltage cables which ensures a more even distribution of power all over the country.

**Task 2. Find the English equivalents for the following words:** сеть высоковольтных кабелей, изменяться, ограничение, разряд электричества, распределение энергии, молния, нести, сеть, яркая вспышка света, металлический стержень, громоотвод. **Write down the transcription of the words. Learn the words.**

**Task 3. Complete the following sentences:**

1. It is made of a metal rod, placed high on the building ... . 2. In order to operate the power stations ... . 3. Just as a thin pipe will not allow water to flow through it ... . 4. These are known as peak and off-peak periods ... . 5. This is a network of high voltage cables ... . 6. When the electric current flows through a conductor ... . 7. If a conductor is made to rotate in the magnetic field ... . 8. There are certain times during the day when ... . 9. The dazzling flash of light we see during a thunderstorm ... . 10. Electricity flowing through a conductor ... . 11. To avoid the risk of damage to buildings ... .

**Task 4. Transfer the following sentences from Active Voice into Passive Voice:**

1. The discharge of electricity from one cloud to another causes the dazzling flash of light. 2. A lightning may strike a building. 3. People use a lightning conductor to avoid the risk of damage to buildings. 4. Man makes a lightning conductor of a metal rod. 5. Man closely connects electricity and magnetism. 6. We use electricity to produce magnetism. 7. We measure the amount of electricity in units called amps. 8. People measure the pressure of electricity in volts. 9. A network of high voltage cables ensures a more even distribution of power all over the country. 10. We make good conductors of copper. 11. Conductors cause the restriction of the flow of current.

**Task 5. Transfer the following sentences into Indirect speech using the phrases: He said that ...; They reported that ...; It was reported that ...; It was announced that ... :**

1. The dazzling flash of light we see during a thunderstorm is caused by the discharge of electricity from one cloud to another. 2. The electricity may pass through a tree or a house. 3. A lightning conductor is made of metal rod, placed high on the building, which is connected by a thick conductor wire to a metal plate buried in the earth. 4. If a conductor is made to rotate in the magnetic field, a pressure of electricity, called a voltage, is produced in it. 5. Electricity flowing through a conductor may be likened to water flowing through a pipe. 6. The amount of electricity, which flows, called the current, is measured in units called amps. 7. Just as a thin pipe will not allow water to flow through it as a large one, so a thin conductor will not allow as much electricity to flow as a thick one. 8. The restriction of the flow which is caused by the conductor is known as its resistance.

9. The resistance of a conductor will also vary according to the material it is made of. 10. In order to operate the power stations more efficiently and economically they are all connected to a grid system. 11. This is a network of high voltage cables which ensures a more even distribution of power all over the country.

**Task 6. Retell the text.**

**Task 7. Translate the text about the Sakmarskaya Heating and Power Plant from Russian into English.**

Электрическая мощность Сакмарской ТЭЦ – 225 тыс. кВт и тепловая мощность – 562 Гкал/ч.

На станции установлены две турбины типа ПТ-60, одна – Т-50 и одна – Т-55, три котлоагрегата ТГМ-84 и один – ПТВН-100. Первый турбогенератор Сакмарской ТЭЦ мощностью 60 тыс. кВт введён в эксплуатацию в 1970 году.

Основным видом топлива Сакмарской ТЭЦ является природный газ, в качестве резервного топлива используется мазут.

Сакмарская ТЭЦ оснащена современным высокоэкономичным оборудованием, средствами автоматизации технологических процессов.

**Task 8. Read and retell the text given below. Do not use a dictionary.**

Proposed 500-kV Line will be Tenaga National Berhad's Transmission Backbone (Part V).  
Difficult Terrain.

The transmission line routes considered have large variations in terrain, including hills and mountains, large rubber and palm-oil-producing plantations and rice padis. As there are relatively few roads in these areas, access can be difficult. Only a narrow pathway is anticipated along the right-of-way.

Typically, builders have constructed transmission lines for Tenaga National Berhad using relatively small equipment and a high concentration of manual labor. For this project, it may be necessary in some areas to carry in water, concrete. Aggregate, cement, tower steel and reinforcing steel. In determining construction procedures, subcontractors must balance the cost associated with available construction techniques with the need to complete the project on schedule. In addition, during line construction, builders must exercise care to interfere as little as possible with palm oil and rubber production. Construction will require a great deal of cooperation between the land owners and the subcontractors.

Rice padis present the greatest foundation and line construction challenge. Preliminary soil data indicate very poor soil conditions as deep as 20 meters. This is coupled with a high water table and flooding associated with rice production. While the rice padis areas are relatively accessible, the construction base in the field will be very soft. Finding suitable locations for structure assembly and wire pulling will be difficult.

**Task 9. Make up written translation of the text. Use a dictionary.**

Innovations in Wind Energy (Part II).

### Limitations Leading to New Developments.

Limited dimensions, increased power and severe operating conditions resulted in SLIM transformer, the new design in transformers that produces more power for less space and provides increased reliability. The SLIM transformer has been developed in close collaboration with a wind turbine manufacturer and DuPont as a material supplier.

The transformers are equipped with integrated, immersed, full-range fuse protection. This increased the challenge for the designers, who had to produce a SLIM transformer that could fit inside a tower door only 600 mm wide. The SLIM transformers are now successfully in operation, helping to generate over 70 million kWh of power at Scotland's second largest wind farm.

At Hanover Fair 2002, the SLIM transformer was featured as an ultra-compact transformer developed specifically for German wind-energy giant Enercon. Designed with the special requirements of the wind-energy market in mind, the SLIM transformer caused a stir at the trade fair, with contractors and wind turbine manufacturers from across Europe expressing interest.

In Germany alone, more than 300 SLIM transformers have been installed in turbine towers.

### **Lesson 6.**

**Task 1. Read the text. Find the translation and transcription of underlined words. Make up a vocabulary. Learn the words.**

#### Insulator Evolution.

The performance of key components, including a wide variety of insulator systems, is vital to overall supply reliability and system safety. When high voltage insulators become degraded causing significant power leakage, subsequent breakdown and flashover on a single critical item of equipment or power circuit, can create a catastrophic system failure.

To meet the demanding requirements for high voltage applications over a minimum design-life of 40 years, well in excess of the normal operational life of most electric power plant and equipment, the raw materials including both silica and alumina are produced to exacting specifications. This includes milling to a very fine uniform consistency in order to eliminate any micro-voids or cracks in the moulded or extruded clay bodies before firing.

A typical 1960s-vintage ceramic disk insulator had a weight of some 25 kilograms. Today the equivalent disk weighs just 14 kilograms, reducing handling problems and the physical workload for linesmen, a particularly important feature when large tension or suspension insulator strings are being installed on transmission towers.

Despite the reduced weight of modern ceramic insulators, the demand for faster, easier overhead installation has resulted in an increasing trend away from traditional ceramic or glass products towards polymeric insulator systems. Some nine times lighter than even the lightest modern ceramic equivalent, moulded

polymeric insulators are rapidly becoming the system of choice for an increasing number of supply companies and power utilities.

**Task 2. Ask disjunctive questions (“tail”-questions):**

**1.** The performance of insulator systems is vital to overall supply reliability and system safety. **2.** When high voltage insulators become degraded a breakdown and flashover on a single critical item of equipment can create a catastrophic system failure. **3.** High voltage insulators cause significant power leakage. **4.** The demanding requirement for high voltage applications is a minimum design-life of 40 years. **5.** The raw materials including silica and alumina are produced to various specifications. **6.** A typical 1960s-vintage ceramic disk insulator has a weight of some 25 kilograms. **7.** Today the disk insulator weighs 14 kilograms. **8.** The disk insulator reduces handling problems and the physical workload for linesmen. **9.** Large tension or suspension insulator strings are being installed on transmission towers. **10.** The demand for easier installation has resulted in an increasing trend towards polymeric insulator systems. **11.** Polymeric insulators are rapidly becoming the system of choice for an increasing number of supply companies and power utilities.

**Task 3. Find key sentences in each paragraph.**

**Task 4. Find key phrases in each paragraph.**

**Task 5. Make up a detailed plan of the text.**

**Task 6. Retell the text using the plan.**

**Task 7. Adapt the sentences given below:**

- 1.** The Alspa P320, a new generation distributed control system, born out of Cegelec’s (France) long-standing expertise in power plant and substation control was designed with two prime goals in mind: help you to generate and deliver energy more efficiently, and reduce your costs.
- 2.** However, there are several common structural changes in the way utilities do business that are seminal to remaining successful as the road is bridged from a regulated era to a competitive era.
- 3.** A recent conference held in Prague, “Energy and Environment: Transmissions in East Central Europe”, organized and co-sponsored by the University of North Dakota’s Energy & Environment Research Center in the United States and the Power Research Institute of Prague, Czech Republic, highlighted the scale of the energy production and environmental control challenges facing the emerging economies of the Central European region.
- 4.** However, improvements are needed, and a report presented at the Prague conference outlined some of the work that has been carried out to reduce hazardous emissions at some plants by improving fuel preparation, optimizing combustion air

distribution, modifying burner configurations, and installing updated control and measurement systems.

5. Since 1990 companies and research institutes from Europe have been working on solar thermal (central receiver systems) power generation technologies, the basic technological concept being the central receiver power plant, in which solar radiation is focused by means of an array of mirrors to a central receiver mounted on the top of a tower.

6. Charlotte Thedeen, the representative of Stockholm Energy Agency (Sweden), which operates the Vartran unit, told the Electric Power Research conference that there have been some initial operating problems, but they are being solved and availability is rising.

7. In common with the latest energy management thinking, the system supplied at Masagua (Venezuela) is based around distributed hardware using fully graphical man-to-machine interfaces comprising work stations and servers with reduced instruction set computing architectures making use of high-speed parallel processing.

8. These adjustments significantly increased the fuel efficiency of the turbine, allowing it to operate at a slightly higher firing temperature than previous models without needing an external blade-cooling air system.

9. The Power Generation Group of Siemens developing an efficient 165 MW heavy-duty combustion turbine that combines Siemens design experience with the aeroengine technology of Pratt & Whitney plans to introduce a family of these advanced machines over the next few months.

10. The China Electric Power Industry Forum provides the opportunity to meet approximately 100 Chinese government and industry delegates, representing the central and six regional Chinese electric power authorities, who are charged with the responsibility for the development of China's electric power industry.

11. The Czech Republic is dependent on the former Soviet Union for supplies of natural gas, which is only likely to be cost-effective if combined-cycle technology is used, nevertheless the investment cost to install a new combined-cycle plant is considered to be too high compared to the cost of cleaning up existing coal-fired power stations.

**Task 8. Read and retell the text given below. Do not use a dictionary.**

Proposed 500-kV Line will be Tenaga National Berhad's Transmission Backbone (Part VI).

Transmission Line Design.

The Project Design Manual for the transmission line addresses electrical clearances, mechanical loading criteria, conductor, optical ground wire, insulators, hardware, accessories, structures and foundations. Of these items, the conductor, structures and foundations will account for approximately 75 percent of transmission line total costs. Optimization of these major items will result in significant savings to Tenaga National Berhad.

Designers analyzed several acceptable conductors with respect to radio interference, television interference and audible noise. Designers also performed

sag and tension analyses of the various conductors to aid in determining structure heights. In addition to electrical effects and sag/tension characteristics, the design team based final selection of the conductor on economics that considered power flow losses over time and the effect of various conductor sizes on structure and foundation costs.

Team designers selected string insulator configurations for the towers because they are standard on 500-kV systems. Insulators will be ball-and-socket type porcelain or toughened glass. The dominant factor in determining the tower configuration was lightning performance. A lightning performance analysis provided the information needed to determine the length of the shield wire arm.

The project will use seven different double-circuit, galvanized lattice-steel structure types with varying line angles. Designers configured all tower types using a computer analysis that optimized the leg slope and tower weight by considering both mild- and high-strength steel.

The team designed the foundations for the towers using preliminary data from soil obtained along the route. Construction will include both pad and pedestal, and pile-type foundations, with rock anchor foundations used in isolated locations. The conductor will be suited for hot-line maintenance tools and will have a strength equal to or greater than the mechanical and electrical rating of the insulators.

**Task 9. Make up written translation of the text. Use a dictionary.**

Innovations in Wind Energy (Part III).

Sky's the Limit.

Transformers were mainly outside the turbine towers in conventional substations. But developments in industry have made increased improvements. For outdoor installations, padmount-type transformers with integrated fuses are developed for the European market. This design is based on the experience of the largest wind farm in the world in Texas, where 214 turbines are connected to the grid.

Indoor designs benefit from the SLIM technology. For example, in Ireland, compact transformers with high-voltage fuses have been designed and installed. From the 600 kW turbine to 4.5 MW, the largest turbine in the world, reliable step-up transformers are in service. Now, SLIM transformers are under development for the new generation of multi-megawatt turbines for offshore conditions.

**Lesson 7.**

**Task 1. Read and translate the text using the words given below. Learn the words.**

Gas Turbine Air Filtration Advancements.

Over the past 20 years the power industry approach to air inlet filtration has dramatically changed. Field professionals began to recognize that air filter replacement is more than just basic equipment maintenance and that it requires much technical consideration. Recent field research data shows that efficient filters



do not only protect the costly equipment, but also contribute to improved turbine performance.

The 1980s marked a new era in gas turbine installations. To combat harsh elements pre-filter wraps were introduced. This innovation was quickly adopted by the industry and resulted in the protection of the primary cartridge filters from the growing level and variety of contaminants.

In the 1990s, operation of pulse-type filter housing designs has become more prevalent worldwide. Many gas turbine operators were critically reviewing how they could maximize power output in each installation. Working directly with gas turbine field professionals facilitated a better understanding of the physical dimension and dynamics of the housings. This then allowed for the development of extended length filter designs.

Recent innovations are geared towards environmental compliance and reduced labour costs. Factory-applied filter wraps and all-synthetic filters are just a few examples. The next generation of filter cartridges contains little or no metal. They are lighter in weight and easier to handle than conventional cartridges. The result is less costly installation. In addition, complete incineration of filter cartridges is achievable with the no-metal filter.

**Words:**

1. approach	подход
2. inlet filtration	входная фильтрация
3. to contribute	способствовать
4. harsh	шероховатый, жёсткий
5. to adopt	принимать
6. contaminant	загрязнение
7. prevalent	распространённый, преобладающий
8. power output	выпуск энергии
9. to facilitate	облегчать, содействовать
10. to handle	обращаться с чем-либо, управлять
11. incineration	сжигание

**Task 2. Complete the following sentences:**

1. Working directly with gas turbine field professionals ... . 2. They are lighter in weight and ... . 3. Field professionals began to recognize that ... . 4. Recent field research data shows that ... . 5. Many gas turbine operators were critically reviewing ... . 6. Recent innovations are geared towards ... . 7. Over the past 20 years the power industry approach to ... . 8. To combat harsh elements ... . 9. In addition, complete incineration of ... . 10. This innovation was quickly adopted ... . 11. Factory-applied filter wraps ... .

**Task 3. Agree or disagree with the following statements:**

1. Over the past 10 years the power industry approach to air inlet filtration has dramatically changed. 2. Complete incineration of filter cartridges is achievable with the metal filter. 3. Recent innovations are geared towards environmental compliance and increased labour costs. 4. The 1980s marked a new era in gas

turbine installations. **5.** Working directly with gas turbine field professionals facilitated a better understanding of the physical dimension and dynamics of the housings. **6.** In the 1980s, operation of pulse-type filter housing designs has become more prevalent worldwide. **7.** Many gas turbine operators were critically reviewing how they could minimize power output in each installation. **8.** The next generation of filter cartridges contains little or no metal. **9.** Recent field research data shows that efficient filters contribute to improved turbine performance. **10.** Field professionals began to recognize that air filter replacement doesn't require much technical consideration. **11.** A better understanding of the physical dimension and dynamics of the housing allowed for the development and retrofit of extended length filter designs.

**Task 4. Form negative sentences:**

**1.** Over the past 20 years the power industry approach to air inlet filtration has dramatically changed. **2.** Recent innovations are geared towards environmental compliance and reduced labour costs. **3.** The next generation of filter cartridges contains little or no metal. **4.** Field professionals began to recognize that air filter replacement requires much technical consideration. **5.** Pre-filter wraps were introduced to combat harsh elements. **6.** They are lighter in weight and easier to handle than conventional cartridges. **7.** Recent field research data shows that efficient filters contribute to improved turbine performance. **8.** The 1980s marked a new era in gas turbine installations. **9.** Field professionals began to recognize that air filter replacement is more than just basic equipment maintenance. **10.** This innovation was quickly adopted by the industry and resulted in the protection of the primary cartridge filters. **11.** Working directly with gas turbine field professionals facilitated a better understanding of the physical dimension and dynamics of the housings.

**Task 5. Choose the right answer for the following questions:**

- |   |  |
|---|--|
| 1. What did field professionals begin to recognize?   | 1. The recent field research data shows that efficient filters only protect the costly equipment.        |
| 2. What does the recent field research data show?   | 2. Complete incineration of filter cartridges is achievable with the metal filter.                       |
| 3. When has the operation of pulse-type filter housing designs become more prevalent worldwide? | 3. Recent innovations are geared towards environmental compliance and reduced labour costs.              |
| 4. What are recent innovations geared towards?  | 4. In the 1980s, the operation of pulse-type filter housing designs has become more prevalent worldwide. |
| 5. What is complete incineration of filter cartridges achievable with?                          | 5. Complete incineration of filter cartridges is achievable with the no-metal filter.                    |
|   | 6. Field professionals began to  |

recognize that air filter replacement is just basic equipment maintenance.

7. In the 1990s, the operation of pulse-type filter housing designs has become more prevalent worldwide.

8. Recent innovations are geared towards environmental compliance.

9. The recent field research data shows that efficient filters do not only protect the costly equipment, but also contribute to improved turbine performance.

10. Field professionals began to recognize that air filter replacement is more than just basic equipment maintenance and that it requires much technical consideration.

#### **Task 6. Retell the text.**

#### **Task 7. Read and retell the text given below. Do not use a dictionary.**

Proposed 500-kV Line will be Tenaga National Berhad's Transmission Backbone (Part VII).

##### Construction Teamwork.

In addition to establishing the quality of materials, equipment and construction required, the design team prepared a Project Field Instructions Manual as a guide for all field personnel. Major sections included the following: field administration, planning and control, permits and licenses, design engineering, equipment and material procurement, construction contracts, construction support services, project completion.

Field administration is a project scope, organization, communication, document control, quality control and daily logs.

Planning and control section is responsible for documentation, information management, schedule, cost, cost analysis and progress reports.

Permits and licenses develop construction constraints and contractor insurance. Design engineering is in charge of design control, drawings and related documents.

Equipment and material procurement is responsible for revisions to contracts, status and quality surveillance, and material receiving and storage.

Construction contracts are revisions to contracts, coordinating and monitoring of construction progress, outstanding work, processing of payments and contractor claims review.

Construction support services are in charge of safety and loss control.

Project completion is the transmission line and substation energization, and compilation of construction records.

Not only will this field manual help construction managers, and inspectors and project subcontractors work as a team, it will also allow them to construct a high-quality transmission system.

**Task 8. Make up written translation of the text. Use a dictionary.**

**A Quantum Leap in Turbine Technology.**

The hydroelectric industry needs a new technology in order to progress. To this end, Polyturbine has conceived, tested and produced a solution that can be best described as a “quantum leap” for the hydro technology industry. This propeller system has been designed to ensure that low-head hydroelectric projects can be developed in the most cost-effective manner possible without impacting on the landscape or river ecosystem. A typical 2 meters head site can be developed at a cost of 1000 euro per installed kW.

In addition, Polyturbine offers a simple, economic and ecologically friendly new technology to develop hydropower installation on rivers that have a large flow and low head. In brief, it involved either installing a number of modular Semi-Kaplan turbines in parallel across an existing weir, or creating a new weir to give a head difference of 2 meters. Both methods have little impact on the landscape and can be combined with a series of lock gates to allow for boat navigation, and with sluice gates to regulate and control water levels during dry periods and flooding.

The fundamental design features of this system are as follows: fixed guide vane assembly and manually adjusted propeller pitch; extensive use of specially designed plastics in the construction of the waterway; a set of moulds for the guide vane assembly and waterway, which guarantees accuracy and low component costs at serial production; a 700 mm diameter, high-speed propeller turbine, which uses an asynchronous motor as the generator; a water-lubricated stave bearing between the propeller shaft and inner guide assembly hub.

**Lesson 8.**

**Task 1. Read and translate the text. Find the Russian equivalents for the following words:** to seek, oil-type capacitor switch, completely, to house, to degrade, maintenance-free attributes, further reducing, solid dielectric single-phase switch, encapsulation, to expand. **Write down the transcription of the words. Learn the words.**

**Vacuums Eliminate Oily Switch Operations.**

Electric utilities companies seeking to eliminate the significant costs of maintaining traditional oil-type capacitor switches on their systems are replacing them with models that use a vacuum to interrupt current. Some are also looking to these switches to address environmental concerns associated with the use of oil in capacitor switch components, and these companies are demanding completely oil-free or “dry” vacuum switches.

Since 1993, Maysteel has offered its Trinetics line of maintenance-free dielectric single-phase vacuum switches, in which the contacts are housed in a vacuum bottle while the unit’s other live components are insulated in oil. In 2002

the company went one step further by expanding the Trinetics line with oil-free UltraVac solid dielectric single-phase vacuum switches.

The oil insulation has been replaced with a rugged, industry-proven epoxy body encapsulation that provides insulation for all the unit's other high-voltage components. As the oil in the Trinetics line of oil-insulated vacuum switches is not used to interrupt current, it never degrades, so no maintenance is required. With the introduction of its UltraVac oil-free switches, Maysteel now offers the maintenance-free attributes of the Trinetics oil-insulated switches in combination with the possibility of further reducing the presence of oil in system components.

**Task 2. Agree or disagree with the following statements:**

**1.** As the oil in the Trinetics line of oil-insulated vacuum switches is not used to interrupt current, it never degrades, so no maintenance is required. **2.** In maintenance-free dielectric single-phase vacuum switches the contacts are housed in a copper bottle. **3.** Maysteel now offers the maintenance-free attributes of the Trinetics oil-insulated switches in combination with the possibility of further reducing the presence of oil in system components. **4.** In maintenance-free dielectric single-phase vacuum switches the unit's live components are insulated in water. **5.** In 2000 the company went one step further by expanding the Trinetics line with oil-free UltraVac solid dielectric single-phase vacuum switches. **6.** The oil insulation has been replaced with a rugged, industry-proven epoxy body encapsulation that provides insulation for few unit's high-voltage components. **7.** Electric utilities companies are replacing traditional switches with models that use air to interrupt current. Rugged, industry-proven epoxy body encapsulation provides insulation for all the unit's high-voltage components. **8.** Electric utilities companies are seeking to eliminate the significant costs of maintaining traditional oil-type capacitor switches on their systems. **9.** Since 1993, Maysteel has offered its Trinetics line of maintenance-free dielectric three-phase vacuum switches. **10.** Environmental concerns are associated with the use of oil in capacitor switch components.

**Task 3. Ask alternative questions:**

**1.** Maysteel has offered its Trinetics line of maintenance-free dielectric singly-phase vacuum switches. **2.** In maintenance-free dielectric single-phase vacuum switches the contacts are housed in a vacuum bottle. **3.** In maintenance-free dielectric single-phase vacuum switches the unit's live components are insulated in oil. **4.** In 2002 Maysteel went one step further by expanding the Trinetics line with oil-free UltraVac solid dielectric single-phase vacuum switches. **5.** The oil insulation has been replaced with a rugged encapsulation. **6.** Rugged encapsulation provides insulation for all the unit's high-voltage components. **7.** Some companies are looking to these switches to address environmental concerns. **8.** Some companies are demanding completely oil-free or "dry" vacuum switches. **9.** Maysteel now offers the possibility of further reducing the presence of oil in system components. **10.** Electric utilities companies are replacing traditional switches with models that use a vacuum to interrupt current.

**Task 4. Transfer the sentences into Indirect speech using the phrases: He said that ...; They reported that ...; It was reported that ...; It was announced that ... :**

1. Electric utilities companies are seeking to eliminate the significant costs of maintaining traditional oil-type capacitor switches on their systems. 2. Electric utilities companies are replacing traditional oil-type capacitor switches with models that use a vacuum to interrupt current. 3. Maysteel has offered its Trinetics line of maintenance-free dielectric single-phase vacuum switches. 4. In maintenance-free dielectric single-phase vacuum switches the contacts are housed in a vacuum bottle while the unit's other live components are insulated in oil. 5. In 2002 Maysteel went one step further by expanding the Trinetics line with oil-free UltraVac solid dielectric single-phase vacuum switches. 6. The oil insulation has been replaced with a rugged, industry-proven epoxy body encapsulation. 7. A rugged, industry-proven epoxy body encapsulation provides insulation for all the unit's high-voltage components. 8. As the oil in the Trinetics line of oil-insulated vacuum switches is not used to interrupt current, it never degrades. 9. As the oil in the Trinetics line of oil-insulated vacuum switches is not used no maintenance is required. 10. Maysteel now offers the maintenance-free attributes of the Trinetics oil-insulated switches. 11. Some companies are also looking to these switches to address environmental concerns associated with the use of oil in capacitor switch components.

**Task 5. Retell the text.**

**Task 6. Translate the text about the Kurgan Electrical Networks from Russian into English.**

Курганские электрические сети были созданы в 1958 году. Сегодня на предприятии работает 769 человек.

В состав предприятия входят 11 районов электрических сетей. Курганские электрические сети состоят из 79 подстанций.

Протяжённость линий электропередач – 2357 километров. Несколько лет назад была построена 500 кВ линия электропередач Курган-Петропавловск протяжённостью 275 км.

**Task 7. Read and retell the text given below. Do not use a dictionary.**

Combined-Cycled Plant Will Set New Standards (Part I).

Introduction.

Yokohama advanced combined-cycle power station is the most efficient and environmentally compliant plant when it begins commercial operation in 1998. Tokyo Electric Power Company first applied combined-cycle technology at its 2000-megawatt Futtsu station. Between 1990 and 1996 fourteen 165-MW single-shaft combined-cycle stages were commissioned. Since 1996 nearly 80,000 hours of operating experience have been accumulated. The gas turbine stages are 1100 C class.

With the advent of 1300 C class gas turbines and environmental friendly technologies, an advanced combined-cycle, with substantially improved performance became possible. Tokyo Electric Power Company commissioned General Electric, Toshiba and Hitachi to study the optimization of this technology. The study has been completed and the detailed design of the plant – eight 350-MW single-shaft combined-cycle stages is performed. The plant is constructed at the Yokohama Thermal Power Station.

In 1996 Tokyo Electric Power Company investigated the use of an advanced combined-cycle plant designed with state-of-the-art features. The objectives of the investigation were: development of a large-capacity, high-temperature gas turbine for greater base and part-load efficiency; reduction of emissions at the gas turbine exhaust and improved selective catalytic reduction system; improved load change rate, start/stop characteristics, operability and maintain ability; improved equipment and systems reliability; reduced construction costs; and use of advantages of scale and optimization of arrangement.

Since there were no 1300 C class gas turbines when the advanced combined-cycle study was started, Tokyo Electric Power Company asked General Electric to manufacture the prototype MS9001F gas turbine and to perform a demonstration run.

Tokyo Electric Power Company participated in verification of the gas turbine design practices and design reliability, and reviewed test results. Tokyo Electric Power Company sought a more stringent environmental performance from the advanced combined-cycle system than was required for the Futtsu plant.

### **Task 8. Make up written translation of the text. Use a dictionary.**

#### Power System Simulation.

Power systems, and the means of controlling and protecting power systems, must be designed to function flawlessly under the most extreme conditions. Since these extremes are rare and dangerous to induce in the actual network, the Real Time Digital Simulator can be used to provide all of the desired contingencies in a safe environment. It enables the study of overall system performance and the behaviour of protection and control components, without endangering people or equipment – and all in real time as if under actual network conditions.

The simulator provides continuous real-time results, as well as allowing user interaction with the simulation, thus delivering an operating environment very similar to a genuine power system. The simulator is able to perform simulations for the study and analysis of electrical power networks ranging from the small to the very large and complex. To date some of its applications have included: closed-loop testing of protective relays; integrated protection and control schemes; closed-loop testing of control systems for synchronous machines; studying general system of operation, including the behaviour of generation and transmission systems; investigating power system equipment interaction; studying interaction between integrated AC/DC systems; developing devices and associated controls; educating and training power system personnel.

At present, the Real Time Digital Simulator is used by an array of clients in over 17 countries.

### **Lesson 9.**

**Task 1. Read the text. Find the English equivalents for the following words:** предварительный, ограничение, проталкивание, когенерация (совместное производство тепла и электричества), ввод в действие (эксплуатацию), переменный, стержень, трубопровод (коллектор), осколки, поперёк. **Write down the transcription of the words. Learn the words.**

#### Temporary High-pressure Air Compressors.

Capital constraints increasingly call for maximum efficiency in the development and start-up processes of cogeneration power plants. A significant requirement for cogeneration power plants is the cleaning, testing and certification of their high pressure steam piping systems prior to commissioning.

A typical cogeneration system is constructed with an engine, steam turbine, or combustion turbine that drives an electrical generator. A waste-heat exchanger recovers waste heat from the engine and/or exhaust has to produce hot water or steam. Cogeneration high-pressure steam piping systems, made up of welded segments of steel pipe, typically contain various types of debris when construction is completed. These unwanted materials must be cleaned out prior to the final connection of the piping system to the turbine. Otherwise, the steam turbine is at a high risk of damage from the high-pressure propulsion of debris into its blades.

High-pressure air compressors provide the air necessary for air blowing. The process begins with calculations to determine transient air flows based on the system's components. The air is supplied from the high-pressure compressor through a manifold system into the newly constructed steam piping. Once the desired pipeline air pressure is achieved, the manifolds are blocked and a downstream valve is opened to the atmosphere. All debris is transmitted downstream and removed from the piping. After several air blows the degree of cleanliness is tested using a target bar, a small mirror finish steel bar placed transversely inside the pipe.

### **Task 2. Complete the following sentences:**

**1.** A significant requirement for cogeneration power plants is ... . **2.** Once the desired pipeline air pressure is achieved ... . **3.** The process begins with ... . **4.** All debris is transmitted downstream ... . **5.** A typical cogeneration system is constructed with ... . **6.** These unwanted materials must be cleaned out prior ... . **7.** The air is supplied from ... . **8.** Cogeneration high-pressure steam piping systems ... . **9.** Capital constraints increasingly call for ... . **10.** After several air blows the degree of cleanliness ... . **11.** Otherwise, the steam turbine is ... .



**Task 3. Form negative sentences:**

1. Capital constraints increasingly call for maximum efficiency in the development and start-up processes of cogeneration power plants. 2. A significant requirement for cogeneration power plants is the cleaning, testing and certification of their high pressure steam piping systems. 3. Typical cogeneration systems consist of an engine, steam turbine or combustion turbine. 4. A combustion turbine drives an electrical generator. 5. Cogeneration high-pressure steam piping systems contain various types of debris. 6. These unwanted materials must be cleaned out prior to the final connection of the piping system to the turbine. 7. The steam turbine is at a high risk of damage from the high-pressure propulsion of debris into its blades. 8. High-pressure air compressors provide the air necessary for air blowing. 9. The process begins with calculations to determine transient air flows based on the system's components. 10. The air is supplied from the high-pressure compressor through a manifold system. 11. After several air blows the degree of cleanliness is tested using a target bar.

**Task 4. Agree or disagree with the following statements:**

1. Capital constraints call for minimum efficiency in the development and start-up processes of cogeneration power plants. 2. A significant requirement for cogeneration power plants is testing of their high pressure steam piping systems. 3. A typical cogeneration system is constructed with an engine, steam turbine, or combustion turbine that drives an electrical generator. 4. Cogeneration high-pressure steam piping systems are made up of welded segments of iron pipe. 5. Cogeneration high-pressure steam piping systems contain various types of debris when construction is completed. 6. Unwanted materials must be cleaned out after the final connection of the piping system to the turbine. 7. The steam turbine is at a low risk of damage from the high-pressure propulsion of debris into its blades. 8. Low-pressure air compressors provide the air necessary for air blowing. 9. The process begins with calculations to determine transient air flows based on the system's components. 10. When the desired pipeline air pressure is achieved a downstream valve is closed. 11. After several air blows the degree of cleanliness is tested using a target bar, a small mirror finish steel bar placed transversely inside the pipe.

**Task 5. Transfer the following sentences from Active Voice into Passive Voice:**

1. Specialists clean and test high pressure steam piping systems of cogeneration power plants. 2. We construct a typical cogeneration system with an engine, steam turbine or combustion turbine. 3. A combustion turbine drives an electrical generator. 4. A waste-heat exchanger recovers waste heat from the engine. 5. Specialists make up cogeneration high-pressure steam piping systems of welded segments of steel pipe. 6. We clean out the unwanted materials prior to the final connection of the piping system to the turbine. 7. High-pressure air compressors provide the air necessary for air blowing. 8. Calculations determine transient air flows. 9. The high-pressure compressor supplies the air. 10. When the desired

pipeline air pressure is achieved, we block the manifolds and open a downstream valve to the atmosphere. **11.** After several air blows specialists test the degree of cleanliness using a target bar.

**Task 6. Retell the text.**

**Task 7. Adapt the sentences given below:**

- 1.** These gas turbines, utilized in combined-cycle operation, can slash fuel consumption, cutting your monthly fuel bills by up to 6 percent compared to other large gas turbine cycles for years to come, and lead to other long term savings, such as significantly lower operations and maintenance costs.
- 2.** In its most recent report, the World Bank declares that the business-as-usual approach to managing the power sector is dead as far as it is concerned, stating that neither the developing countries nor the Bank can continue to ignore the ongoing macroeconomic difficulties of many of those countries and the changing world global environment.
- 3.** Alfa Laval (Sweden) founded in 1883 to develop the technical innovations of Swedish inventor Gustav de Laval since then has continued his innovative approach to meet the changing needs of the power industry offering the best fuel and lubricating oil treatment systems in order to satisfy its customers.
- 4.** In the industrial city of Darhan (Mongolia), the 192 MW power plant was barely functioning due to the lack of spare parts and a deteriorated condition though the plant is the city's sole source of heat, creating an urgent and dangerous situation.
- 5.** Coal used by the plant contains boulders and does not meet the delivery standards set by the plant operators thus causing severe difficulties in the operation of the coal preparation system.
- 6.** Bechtel Power Corporation has been advancing combustion turbine technology for over 25 years with modular approach that uses standardized designs and integrated systems that can be easily combined and expanded thus keeping construction costs down, shortening schedules and building in superior quality.
- 7.** Government commitment to a limited development of renewable capacity is well documented, although many groups feel that the targets should be more ambitious as the United Kingdom is well placed to take advantage of both wind and wave energy.
- 8.** Independent generators are constrained by their financiers, and as long as the pool fails to provide a secure basis for capacity income, scope for future independent generators looks limited.
- 9.** Capital costs for a gas turbine power plant are half that of a comparable fossil fuel-fired power plant and construction lead time is no more than one year, because of the units' low capital cost, environmental advantaged and high efficiencies, the market for gas turbines looks very promising.
- 10.** The capacity and performance of gas turbines degrade as the inlet temperature increases that is why a summer peaking utility will find that its gas turbine output is at its lowest when the utility needs the most capacity.

11. One feature of the MS6001FA gas turbine is its front-end drive, which allows the turbine to exhaust its hot gases directly into a heat recovery steam generator, reducing the need for ducting around the generator.

**Task 8. Read and retell the text given below. Do not use a dictionary.**

Combined-Cycled Plant Will Set New Standards (Part II).

Plant Requirements.

Tokyo Electric Power Company required that thermal efficiency of the advanced combined-cycle be more than 10% better than the Futtsu plant. The advanced combined-cycle plant will operate above 53% thermal efficiency on a lower heating value basis — 20% higher than a 1000-MW conventional steam power plant.

Operational characteristics are required to meet load change rates of 5.5% per minute. Again, this is 10% greater than the Futtsu plant. The advanced combined-cycle will reach full load at hot start within 60 minutes. (The Futtsu project also had this requirement.)

Tokyo Electric Power Company selected the single-shaft configuration based on the experience gained from the combined-cycle operation at the Futtsu plant. Tokyo Electric Power Company says the single-shaft combined-cycle is easy to start and stop and, because each stage is operated independently, it has low losses.

Combined-cycle operation has high thermal efficiency at rated load and the efficiency can be maintained over a wide range of loads. This is accomplished by increasing or decreasing the number of operating stages. Thermal efficiency is not affected during periodic inspection of equipment.

The advanced combined-cycle uses a reheat steam cycle. With the single-shaft reheat cycle there are no constraints related to various operating conditions of the gas turbines. However, this is not the case with multi-shaft combined-cycle configurations.

**Task 9. Make up written translation of the text. Use a dictionary.**

Treated Timber Transmission Poles.

HWJ timbers manufactures, supplies and distributes treated timber transmission poles for the power and telecommunication industries. Over a 12-year period HWJ Timbers has established and developed strategic alliances with carefully selected partners in the timber industry. Delivering superior service and competitive pricing while fuelling growth, the company focuses on relationship marketing rather than short-term customer and supplier relationships.

Locally, in the telecommunications industry Telkom South Africa Ltd. Is an important client while, in the power industry poles are supplied to South Africa's electricity supply authority ESKOM, as well as to various electrical engineering contractors, municipalities and the agricultural market. Clients abroad are served either directly or through strategic selected agents.

With another plant established in South Africa's Tzaneen area in full production, 80,000 poles of various dimensions can be produced and supplied per month. Following the international trend in supply management, a just-in-time

philosophy is followed to guarantee timely and speedy deliveries. A depot has been established in Pretoria to ensure continuous availability and prompt delivery of timber products.

Production materials are mainly sourced from local plantations, although foreign eucalyptus gum is available. The treating process involves: sourcing of raw material, felling of trees and transporting to plant; drying of poles in kilns or wind drying in stacks; treating of dried poles in a pressure cylinder with preservation chemical; distribution of end product to clients. Quality checks are carried out to ensure full compliance with the South Africa Bureau of Standards.

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## АНГЛИЙСКИЙ ЯЗЫК

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